

DEGRADATION CONTROL OF ENVIRONMENTALLY  
DEGRADABLE DISPOSABLE MATERIALS

Cross-Reference to Related Applications

The present application is a continuation of U.S.

- 5 Patent Application Serial No. 07/949,675 filed September  
22, 1992, <sup>abandoned</sup> which is a continuation-in-part of pending U.S.  
Patent Application Serial Nos. 07/579,000, <sup>USP 5,210,050</sup> entitled  
"Blends of Polylactic Acid"; 07/579,005, <sup>USP 5,180,745</sup> entitled  
"Biodegradable Packaging Thermoplastics from Polylactic  
10 Acid"; 07/579,460, <sup>USP 5,354,648</sup> entitled "Degradable Impact Modified  
Polylactic Acid"; and 07/579,465, <sup>abandoned</sup> entitled "Biodegradable  
Replacement of Crystal Polystyrene"; all filed on Sept. 6,  
1990; which are continuation-in-parts of U.S. Patent  
Application Serial Nos. 07/387,676; 07/387,678;  
15 07/386,844; and 07/387,670; respectively, all filed on  
July 31, 1989, and now abandoned; which are continuation-  
in-parts of U.S. Patent Application Serial Nos.  
07/229,894, filed Aug. 8, 1988; 07/229,896, filed Aug. 8,  
1988; 07/317,391, filed March 1, 1989; and 07/229,939,  
20 filed Aug. 8, 1988; respectively, now abandoned; and all  
of which are incorporated by reference herein in their  
entirety.

Field of the Invention

- 25 The present invention relates to a method for  
controlling the degradation rate of biodegradable  
disposable materials which can substitute for common  
environmentally nondegradable plastics, thereby reducing  
accumulation of wastes in the environment. The present  
invention discloses means to provide materials that are

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degrades hydrolytically during operative and disposal stages in a controlled manner such that the disposal degradation rate of the material is accelerated relative to the operative degradation rate (the operative degradation rate comprising an average of the storage disposal rate and use disposal rate) of the material. Preferably, the operative degradation rate, which can be measured by a change in molecular weight over time, is less than about 50 percent of the disposal degradation rate, more preferably less than about 33 percent, even more preferably less than about 10 percent, and even more preferably less than about 5 percent of the disposal degradation rate. The disposable material is capable of being at least about 98 percent, and preferably about 100 percent, hydrolytically degraded after discard. The material is preferably at least about 98 percent hydrolytically degraded, and more preferably about 100 percent hydrolytically degraded, within about ten years, more preferably within about five years, and even more preferably within about three years. The disposable material can also be degraded by other mechanisms such as biological, chemical, mechanical, photo, and thermal degradation. Disposable materials that are further degraded by biological, preferably microbial, degradation can be degraded essentially to carbon dioxide and water or to carbon dioxide and methane. The disposable material is preferably a film, foam, coating, or molded article, but

### Brief Description of the Figure

Figure 1 is a schematic depicting the degradation of a film that contains environmentally degradable disposable materials of the present invention.

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### Detailed Description of the Invention

One embodiment of the present invention is an environmentally degradable disposable material which includes a hydroxycarboxylic acid-containing polymer and which degrades hydrolytically during operative and disposal stages in a controlled manner such that the disposal degradation rate of the material is accelerated relative to the operative degradation rate of the material.

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15 An environmentally degradable disposable material of the present invention includes any one-way hydroxycarboxylic acid polymer-containing plastic that does not undergo significant degradation until it is discarded. As used herein, disposable materials of the present invention exist through two stages. The operative stage, during which there is minimal degradation, begins immediately following production of the material and continues until the material is discarded, but excludes any processing performed during this time period. As such, the operative stage includes the time during which the material is stored (sometimes called shelf-life) and used. In one embodiment in which disposable materials of the present invention are packaging materials, the

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